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ABSTRACT

This study investigates the relationship between Ghanaian children's acquisition of conservation and their age, parental profession and schooling or lack of schooling. Subjects were 120 females, 40 in each of three age groups (6-7, 8-9 and 10-11 years). Half of the subjects in each group had parents in traditional African professions such as pottery making and half in non-traditional professions. Subjects were given two Piagetian tasks (quantity and amount). Major findings indicated that conservation was related to age, task and parental profession but not to schooling except where it seemed to interfere with the experiences of the traditional professional group. Subjects who were older and from the traditional parental profession group scored highest and the quantity task was the easier one. Ghanaian subjects conserved at the same ages as western subjects. (MS)

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Acquisition of Conservation in Ghanaian Children

Kwaku Armah and Marjorie Arnold

If you review the cross-cultural studies of conservation, you'll find enormous differences in the results obtained, the tasks used, scoring methods selected, etc. Comparing studies is almost impossible. For example, if you want to look at the age at which children in different cultures acquire conservation, you can find studies that show no age difference across cultures. The problem is that you can also find evidence that nonwestern children acquire conservation at a later age. And you can even find evidence that nonwesterners never achieve concrete or formal operations.

Given such discrepant results, some researchers have conducted within-culture studies, to identify the particular experiences that differentially affect cognitive growth. One of the variables most often cited is the presence or absence of schooling (Furby, 1970; Mohseni, 1966; Greenfield, 1966; & Prince, 1968). To many investigators, the rate of cognitive development is assumed to be strongly related to western culture and training. Prince (1968) even proposes a closer relationship between conservation and school grade level than conservation and age. Such a position implies that conservation is related to western schooling experience.

Other investigators view schooling as merely one specific variable, and probably not even the most important one, of a complex cluster of experiences responsible for cognitive growth (Price-Williams, et al. 1969, Ayisi, 1972). What are the data about the effect of schooling in particular? Again, studies can be found to support almost any position. Across different cultures, you

may find that schooled children still show consistent non-conservation responses.(Greenfield, 1966; Price-Williams, 1962; Bovet, 1971; de Lemos, 1960). On the other hand, a number of children and adults with no schooling experience at all, do show conservation (Prince, 1968; Johoda, 1971; Piller, 1971).

It seems clear that educational systems must vary greatly from culture to culture. If so, as long as we continue to treat schooling as a global variable, as more or less standard across cultures, we will continue to get conflicting and uninterpretable responses. What we need to do is to analyze the different types of experiences that schooling may provide in different cultures--what happens during the school experience that is likely to promote, interfere with, or have no effect on cognitive abilities? In addition, we need to look at what an unschooled child is doing while she is not in school. What kinds of experiences is she having that may affect cognitive development?

The problem with trying to do this kind of research is that many of the important variables overlap in highly industrialized societies. For example, in countries like ours, which have a pervasive system of formal education, maturational development and education are confounded. Many cultures, however, do provide the opportunity to study children of the same age groups who differ only in whether they have attended school or not.

Ghana, in West Africa, is such a country. It also has a school system quite unlike many Western schools, but not at all in touch with the traditional Ghanaian culture. Schools in Ghana have been primarily influenced by the

British colonial government there. Thus they were set up as places to train interpreters, postal clerks, and other clerical workers essential to the functioning of the government.

All elementary and high schools are uniform in terms of curricula, methods and materials. Almost without exception, classroom instruction takes place verbally, in a rather formal setting. Children may see diagrams and photographs of objects they are learning about, but the physical objects themselves are seldom available. There is a great deal of rote memorization of facts. What is important here is the fundamental difference in the content of Ghanaian schooling and those of western cultures. Our schools tend to offer a far greater variety of experiences for interacting with a wide selection of materials-by counting, measuring, shaping, rearranging, etc. In contrast to the clerical and bureaucratic jobs for which Ghanaian schools train their students, there are traditional professions in Ghana. These are producing and/or selling, on minimal scale, local items such as pottery, palm wine, palm oil, peanuts, rice, etc. The acquisition of the skills necessary for these professions occurs primarily through observation and direct participation in the home or market place. These skills are typically ignored by the schools. If parents are involved in one of these traditional economic trades, children are often not only encouraged but required to participate. In the homes of the potter, for example, the young girls are involved in rolling, shaping and weighing the clay to fit the mold. In place of toys, even preschoolers are often given bits of the material to keep them occupied. Thus, through their everyday activities, Ghanaian children may get more opportunity to manipulate

different objects and see their possible transformations than they do in the schools.

Viewed from this perspective, it is not difficult to hypothesize that the skills underlying the ability to conserve are learned outside the Ghanaian school rather than in it. Our study, then, is an examination of how the schooling and home experiences of Ghanaian children affect the acquisition of conservation. Our major independent variables were parents profession (traditional or non-traditional), schooling (school or no school) and age of the subjects.

If you will look at Table 1 on p. 1 of your handout, you will see the design of our study. Our subjects were 120 girls, ages 6-7, 8-9, and 10-11 years. We used females because they are more likely than males to engage in the traditional professions we wanted to study. The subjects were chosen from two population groups found in three semi-rural towns in Ghana. The first group consisted of all girls in the towns within our age range whose parents were engaged in traditional or native Ghanaian professions. All girls whose parents were engaged in non-traditional or clerical professions formed the second population group.

Next we subdivided each of the two populations into girls who had attended school for at least a year or more (depending on their age) and those who had not attended school at all. For the schooled children, 6-7 year olds were in the first grade, 8-9 year olds in the 2nd., and 10-11 year olds in the 3rd. The use of two profession groups, three ages, and two levels of schooling

gave us 12 independent groups and we randomly selected ten subjects for each group. All subjects were tested on both quantity and amount.

We used the standard materials for testing conservation--different sized beakers with colored water for continuous quantity and two balls of yellow plasticine for amount. All interviews were conducted in Twi, the native language of our subjects. It was essential that our questions unambiguously refer to equality of amount rather than equal perceptible level. To be sure of this, we had the interview translated into Twi by experts from the Institute of Ghanaian Languages at the University of Ghana.

We used a standardized individual version of the Piagetian interviews and added an orientation session at the beginning to make sure our subjects understood the tasks. Each of the two conservation tasks consisted of three subtests. The conservation of quantity task involved pouring a given quantity of water into a tall thin beaker, a shallow wide beaker, and finally into six smaller, thinner beakers. Conservation of amount involved rolling the ball of clay into a sausage shape, a banana shape, and a donut shape. Order of presentation for the two tasks was counterbalanced.

Responses to the two conservation tasks were classified, independently of each other. Based on the child's response and her explanation for it, they were categorized as not conserving, partially conserving, and conserving. To make our procedures compatible with those of other researchers, these categories were then assigned the numerical values of 0, 2, and 3 respectively. These numerical values were averaged across the three subtests to obtain a score for each task, and these scores were used for our analyses.

Now look at Table 2 of your handout. To test our hypotheses, we ran a 2 x 2 x 2 x 3 ANOVA (2 professions, 2 levels of schooling, 2 tasks, and 3 ages) with repeated measures on the task variable. As expected, we found a significant main effect for age--the older the subjects, the higher they scored on both tasks. You can see this clearly in Figure 1 of your handout.

From Figure 1 and Table 2 you can also see that there was a significant effect for task. Conservation of quantity was easier than conservation of amount at all ages, for both profession groups. The means and standard deviations for the scores are in Table 3. Although other investigators both in America (Almy, 1967) and Uganda (Otaala, 1973) have found conservation of quantity to be acquired earlier, this result is difficult to interpret. In our study it first seemed unlikely that it was a direct function of differential exposure to experiences related to the two types of abilities. Most of our subjects had more exposure to amount-related experiences (e.g. working with clay or flour dough) than to quantity-related ones (such as palm oil or gari). However, it may be that the process involved in understanding amount, as defined here, may require the understanding of quantity. Tying this to the everyday experiences of our subjects, we are saying that working with many amount-related substances such as flour dough requires by definition working with continuous quantity such as water. The opposite, however, may not be true. Working with palm oil or palm wine may require an understanding of continuous quantity but not amount.

Looking back at Figure 1, you can also see that we got a Task x Age interaction, which was significant. Performance on the quantity task was

well above that on amount at the younger ages, but there was no significant difference on performance by age 10.

And now on to our most interesting results. From the ANOVA table, it is clear that we did get a significant effect for parental profession. Overall, girls whose parents were engaged in traditional Ghanaian professions performed better on the tasks than those with parents in non-traditional professions. Notice however, that we did not find a significant main effect for schooling. Contrasting the types of experiences children have in the Ghanaian schools with those they get by learning a traditional profession, this result is not surprising. Overall, conservation ability was independent of schooling.

Although we did not find a significant Profession x Schooling interaction, a look at Table 3 reveals that the unschooled girls did better on both of the tasks than those attending school. Looking more closely at this, we found one of our most intriguing results. Performance of the girls in the traditional profession group who did not go to school was higher than performance of those who did. Figure 2 gives you an example of how this interaction looks for this group on the quantity task where it was significant. These differences would seem to be a direct function of the degree of participation in traditional activities. The participation of unschooled girls in such activities is generally uninterrupted. But, due to homework and other school-related activities, girls who go to school get less exposure to these experiences. We didn't find these differential effects for schooling in the nontraditional profession group.

I should mention two other results briefly. First, our Ss showed conservation at the same ages as western children in other studies--there was no delay. For both tasks more than 75% of the girls in the two older groups conserved--a result compatible with Piaget's criteria. Second, the justifications they gave for their responses also followed the pattern found by Piaget and his collaborators. Most nonconservers referred to the perceptual and descriptive features of the materials. Reversibility and compensation reasons were conspicuous only among the conservers.

To conclude--we found conservation related to age, task, and parental profession--but not to schooling except where it seemed to interfere with the experiences of the traditional profession group. Goviously, we need more precise information on the nature of schooling as it effects cognitive growth. We are making no exclusive claim about the role of traditional professions. Rather we have identified them as one setting in Ghana which is more fruitful than others for encountering the experiences that lead to cognitive development.

ACQUISITION OF CONSERVATION
BY GHANAIAN CHILDREN

Kwaku Armah and Marjorie Arnold
Rutgers University
S.R.C.D., March, 1977

TABLE 1

Distribution of Subjects According to
Parental Profession, Schooling, Task, and Age (N = 120)

	Traditional Professions		Nontraditional Professions	
	Schooled	Unschooled	Schooled	Unschooled
Age	Quantity & Amount	Quantity & Amount	Quantity & Amount	Quantity & Amount
6-7	10	10	10	10
8-9	10	10	10	10
10-11	10	10	10	10

Note: Responses to the conservation questions were scored as either Not Conserving, Partially Conserving, or Conserving.

TABLE 2

Analysis of Variance of
Conservation Scores

Source	SS	DF	MS	F	p
Profession	9.200	1	9.200	12.041	**
Schooling	2.889	1	2.889	3.781	-
Age	78.993	2	39.497	51.697	**
Task	4.535	1	4.535	5.935	*
Prof x Sch	0.505	1	0.505	0.660	-
Prof x Task	0.445	1	0.445	0.79	-
Sch x Task	0.004	1	0.004	0.006	-
Prof x Age	2.369	2	1.184	1.549	-
Sch x Age	2.029	2	1.015	1.322	-
Task x Age	5.645	2	5.645	7.383	*
Prof x Sch x Task	.000	1	0.000	0.000	-
Prof x Sch x Age	1.007	2	0.504	0.038	-
Sch x Task x Age	0.058	2	0.029	0.038	-
Prof x Sch x Task x Age	0.034	2	0.017	0.022	-
Error	165.072	216	0.764	-	-
Total	271.220	239	1.135	-	-

* $p < .01$

** $p < .001$

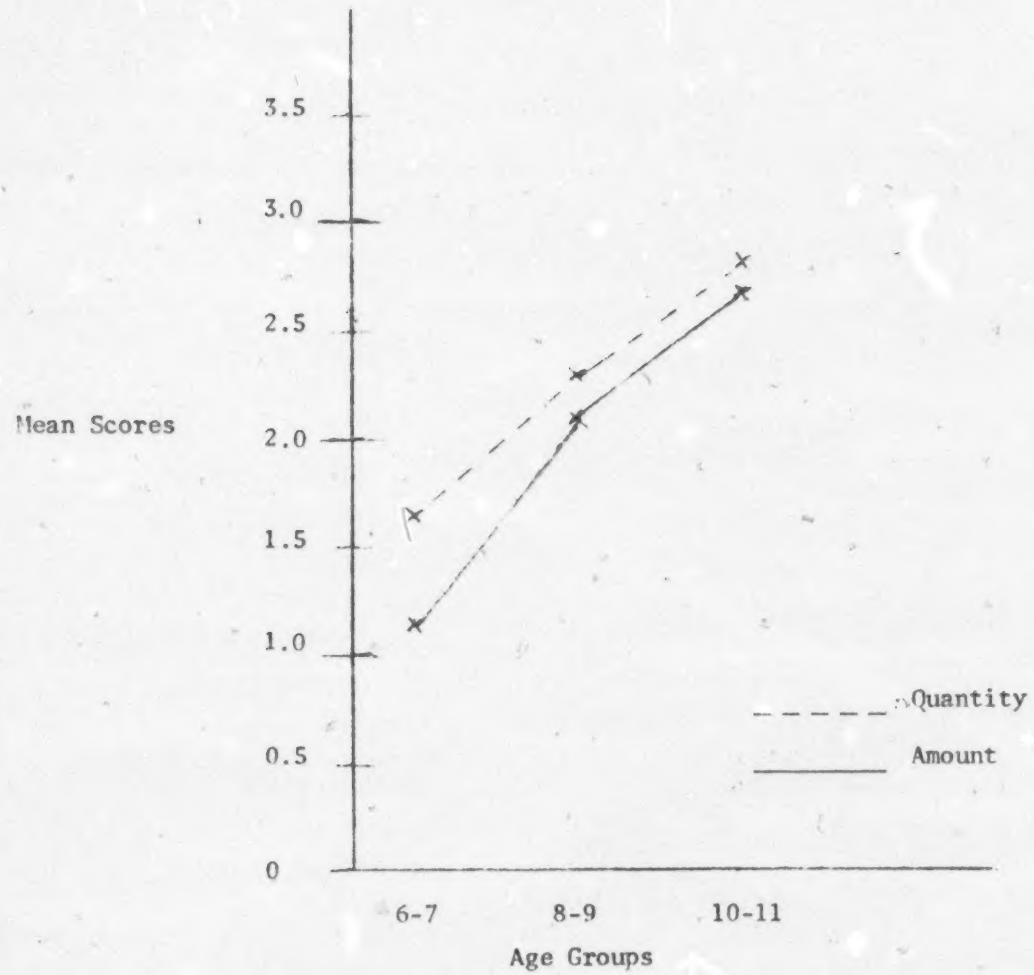

Figure 1. Mean scores on both tasks by age.

TABLE 3

Means and Standard Deviations for all Groups on the Two Conservation Tasks (N=120)

Groups	Tasks			
	Quantity		Amount	
	M	SD	M	SD
Professions				
Traditional	2.49	(0.48)	2.13	(0.53)
Nontraditional	2.04	(0.61)	1.83	(0.94)
Schooling				
Schooled	2.15	(0.83)	1.87	(0.95)
Nonschooled	2.36	(0.79)	2.00	(0.81)
Age				
6-7	1.67	(0.52)	1.10	(1.03)
8-9	2.30	(0.42)	2.08	(1.19)
10-11	2.80	(0.42)	2.72	(0.90)

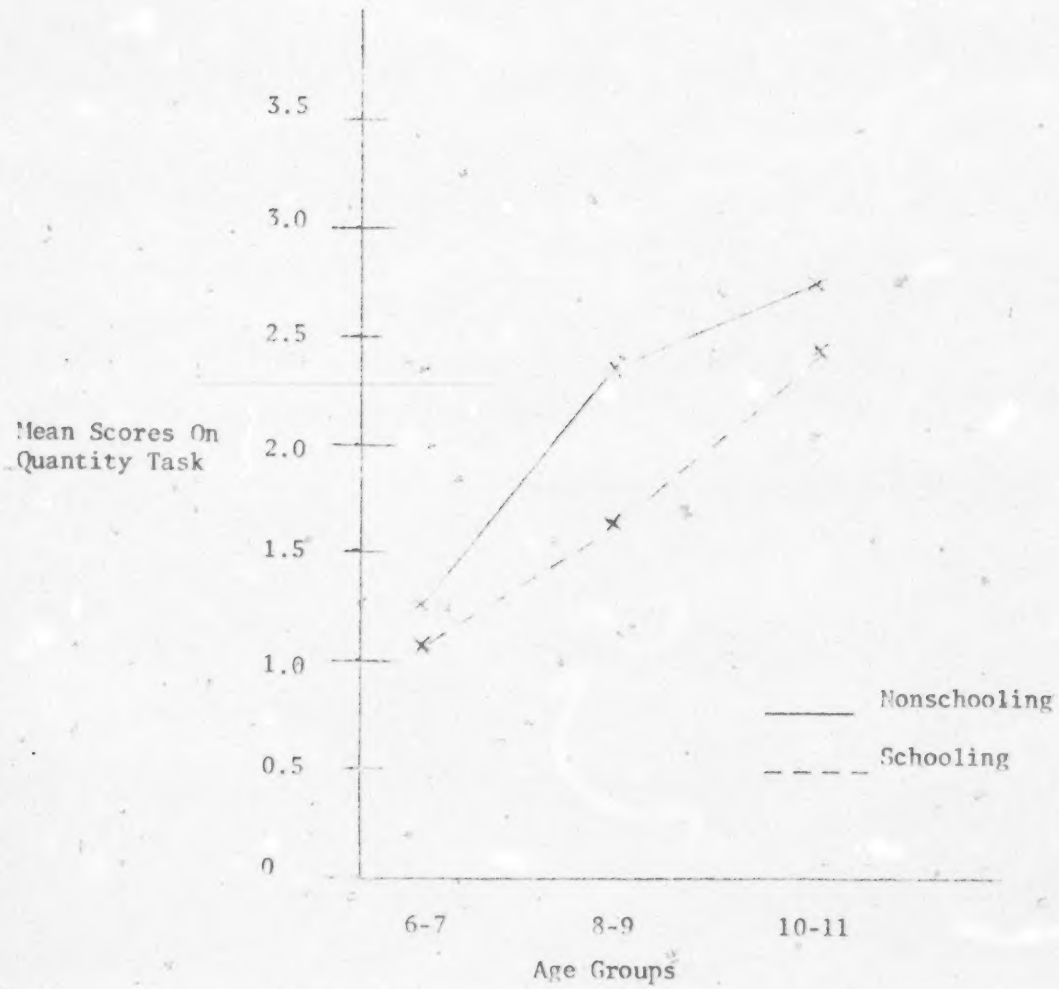

Figure 2 Mean scores on quantity task by schooling and age within traditional profession.